PLANT ITEM MATERIAL SELECTION DATA SHEET

R10344402

RLD-VSL-00002 (HLW)
Offgas Drains Collection Vessel

- Design Temperature (°F)(max/min): 167/40
- Design Pressure (psig) (internal/external): 15/FV
- Location: incell

ISSUED BY
RPP-WTP PDC
UNIT DATE

Contents of this document are Dangerous Waste Permit affecting

Operating conditions are as stated on sheets 5 and 6

The solution is from vapor phase carry-over from HOP-HEME-00001A/B and HOP-HEME-00002A/B.

Not maintainable during the 40 y design life.

Operating Modes Considered:

- The vessel is pH ≈ 2.4 at the normal operating temperature.

Materials Considered:

Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00		X
316L (S31603)	1.18	X	
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

Recommended Material: 316 (max 0.030% C; dual certified)

Recommended Corrosion Allowance: 0.04 inch (includes 0.00 inch erosion allowance)

Process & Operations Limitations:

- Develop rinsing/flushing procedure for acid and water.
- Develop lay-up strategy.

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8/5/04
EXPIRES: 12/07/05

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This bound document contains a total of 6 sheets.

REV	DATE	REASON FOR REVISION	PREPARER	CHECKER	APPROVER
0	8/5/04	Issued for Permitting Use		APR	

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Corrosion Considerations:

This vessel receives little or no transfer of effluent during normal operation. It can receive condensate from the low points in the main offgas ductrs downstream of the HOP HEMEs (consider composition consistent with that of the HEMEs), decontamination effluent from HLW C5 drains, and plant wash for level makeup.

a General Corrosion
Hamner (1981) lists corrosion rates for 304 (and 304L) and 316 (and 316L) of less than about 1 mpy in dilute nitric acid solutions. Based on Uhlig (1948), little uniform corrosion is expected at these conditions. The stated solutions are compatible with the 300 series stainless steel.

Conclusion:
The 300 series alloys are expected to be acceptable.

b Pitting Corrosion
No significant concentrations of pitting agents are shown. Due to the possibility of the solution concentrating in the vessel, 316L is recommended.

Conclusion:
Pitting is not expected to be a concern. 316L is minimum recommended.

c End Grain Corrosion
End grain corrosion only occurs in highly oxidizing acid conditions.

Conclusion:
Not applicable.

d Stress Corrosion Cracking
The exact amount of chloride required to cause stress corrosion cracking is unknown. In part this is because the amount varies with temperature, metal sensitization, and the environment but also because chloride tends to concentrate under heat transfer conditions, by evaporation, and electrochemically during a corrosion process. Hence, even as little as 10 ppm can lead to cracking under some conditions. As seen in Sedriks (1996) and Davis (1987), stress corrosion cracking does not usually occur below about 140°F.

With wash lines available and expected temperature shown at 125°F, there should be minimal chance of cracking.

Conclusion:
Based on the normal operating environment, 316L is recommended.

e Crevice Corrosion
With the stated operating conditions, 316L is the minimum acceptable. Also see Pitting.

Conclusion:
See Pitting.

f Corrosion at Welds
Corrosion at welds is not considered a problem in the proposed environment.

Conclusion:
Weld corrosion is not considered a problem for this system.

g Microbiologically Induced Corrosion (MIC)
The proposed operating conditions are conducive to microbial growth though in this part of the system microbial contaminants are not expected.

Conclusion:
MIC is not considered a problem.

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h Fatigue/Corrosion Fatigue
Corrosion fatigue is a not expected to be a concern.

Conclusions
Not expected to be a concern.

i Vapor Phase Corrosion
Not expected in this system.

Conclusion:
Not a concern.

j Erosion
Velocities are expected to be low.

Conclusion:
Not a concern.

k Galling of Moving Surfaces
Not applicable.

Conclusion:
Not applicable.

l Fretting/Wear
No contacting surfaces expected.

Conclusion:
Not applicable.

m Galvanic Corrosion
No dissimilar metals are present.

Conclusion:
Not expected to be a concern.

n Cavitation
None expected.

Conclusion:
Not believed to be of concern.

o Creep
The temperatures are too low to be a concern.

Conclusion:
Not applicable.

p Inadvertent Nitric Acid Addition
Vessel operates at low pH under normal conditions.

Conclusion:
Not applicable.

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References:

1. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
2. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX 77218
3. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158
4. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, Inc., New York, NY 10158

Bibliography:

1. Agarwal, DC, *Nickel and Nickel alloys*, In: Revie, WW, 2000. *Uhlig's Corrosion Handbook*, 2nd Edition, Wiley-Interscience, New York, NY 10158
2. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
3. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084

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OPERATING CONDITIONS

PROCESS CORROSION DATA SHEET

Component(s) (Name/ID #) Offgas drains collection vessel (RLD-VSL-00002)

Facility HLW

In Black Cell? Yes

Chemicals	Unit[1]	Contract Maximum		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/l	3.33E-04	3.17E-04			
Chloride	g/l	1.01E-02	1.72E-02			
Fluoride	g/l	5.71E-03	1.21E-02			
Iron	g/l	2.08E-03	7.67E-04			
Nitrate	g/l	1.13E+00	7.67E-01			
Nitrite	g/l					
Phosphate	g/l					
Sulfate	g/l					
Mercury	g/l	6.77E-01	5.78E-01			
Carbonate	g/l					
Undissolved solids	wt %	0.07%	0.06%			
Other (NaMnO4, Pb,...)	g/l					
Other	g/l					
pH	N/A					Note 2
Temperature	°F					Note 3

List of Organic Species:

Notes:

1. Concentrations less than 1x 10^{-4} g/l do not need to be reported; list values to two significant digits max.
2. pH ≤2.5 to 6.5, assumes condensate is worst case
3. Tmin 59 °F, Tnorm 125 °F, Tmax 141 °F

Assumptions

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5.6.4 Offgas Drains Collection Vessel (RLD-VSL-00002)

Routine Operations

The offgas drains collection vessel (RLD-VSL-00002) is in a black cell and receives little or no transfer of effluent during normal operation. Vessel RLD-VSL-00002 receives the following: condensate from the low points in the main offgas ducts downstream of the HEMEs (HOP-HEME-00001A/B and HOP-HEME-00002A/B); condensate from the pulse ventilation system header; and plant wash for level makeup to maintain hydraulic seal between the pulse jet ventilation system (PJV), the primary offgas system (HOP) and the C5 cell. The vessel contents are transferred to the plant wash and drains vessel RLD-VSL-00008. The drain lines must be dipped below the liquid level in the vessel to maintain a static water column in the drain line that will balance the pressure differential between the drain location and the vessel vent system. To ensure that the drain lines are below the liquid level, makeup water from the plant wash system will be added to the vessel to compensate for evaporation when condensation does not occur in the offgas system.

Non-Routine Operations that Could Affect Corrosion/Erosion

Receives highly acidic effluent from the HEME.